CLAIMS

We claim:

1. A process for slurry polymerization of olefins and for separating polymer solids from diluent, the process comprising:

polymerizing in a reaction zone at least one olefin monomer in a liquid diluent to produce a fluid slurry comprising the liquid diluent and polymer solids;

withdrawing a portion of the slurry from the reaction zone;

heating the withdrawn portion of the slurry;

passing the withdrawn portion of the slurry to an intermediate pressure zone in which a majority of the diluent is separated from the polymer solids, wherein the intermediate pressure zone is at a pressure in the range of from 100 psia to 1500 psia;

withdrawing the polymer solids from the intermediate pressure zone; and

transferring the polymer solids to a purge zone without passing through a flash zone.

2. A process according to claim 1 wherein the intermediate pressure zone is at a pressure within the range of from 130 to 190 psia.

3. A process according to claim 1 wherein the intermediate pressure zone is at a temperature in the range of from 100°F to 250°F.

4. A process according to claim 3 wherein the separated diluent is condensed without compression after the intermediate pressure zone.

5. A process according to claim 1 wherein a top valve, a fluff collection zone, and a bottom valve are disposed between the intermediate pressure zone and the purge zone, and

the polymer solids are transferred from the intermediate pressure zone to the purge zone by the following steps:

(i) opening the top valve when the bottom valve is closed;

(ii) passing the polymer solids into the fluff collection zone;

(iii) closing the top valve while the bottom valve remains closed after the level of polymer solids in the fluff collection zone reaches a first desired level;

(iv) opening the bottom valve while the top valve remains closed, thereby passing the polymer solids the purge zone; and

(v) closing the bottom valve when the level of polymer solids in the fluff collection zone reaches a second desired level.

6. A process according to claim 5 further comprising the steps of decreasing the pressure within the fluff collection zone between steps (iii) and (iv), and increasing the pressure within the fluff collection zone after step (v).

7. A process according to claim 1, further comprising transferring the polymer solids from the intermediate pressure zone to a transporter zone; and

transferring the polymer solids from the transporter zone to the purge zone by a force other than gravity.

8. A process according to claim 7, further comprising heating the polymer solids after the transporter zone.

9. A process according to claim 1, further comprising transferring the polymer solids from the intermediate pressure zone to a first transfer zone;

transferring the polymer solids from the intermediate pressure zone to a second transport zone;

when the level of the polymer solids in the first transfer zone reaches a desired level.

10. A process according to claim 1, wherein the polymer solids are transferred to the purge zone primarily by flash gas from the intermediate pressure zone.

11. A process according to claim 1 wherein the polymer solids are substantially free of unentrained diluent after the intermediate pressure zone.

12. A process according to claim 11 wherein the polymer solids are substantially free of entrained diluent after the purge zone.

13. A process for slurry polymerization of olefins and for separating polymer solids from diluent, the process comprising:

polymerizing in a reaction zone at least one olefin monomer in a liquid diluent to produce a fluid slurry comprising the liquid diluent and polymer solids;

withdrawing a portion of the slurry from the reaction zone;

passing the withdrawn portion of the slurry to an intermediate pressure zone in which a majority of the diluent is separated from the polymer solids, wherein the intermediate pressure zone is at a pressure in the range of 100-1500 psia;

withdrawing the polymer solids from the intermediate pressure zone;

monitoring the level of the polymer solids in the intermediate pressure zone; and

adjusting the withdrawal of the polymer solids from the intermediate pressure zone in response to the monitored level.

14. A process according to claim 13 further comprising maintaining a sufficient level of the polymer solids in the intermediate pressure zone to provide a pressure seal for intermediate pressure zone.

15. A process according to claim 13 wherein the polymer solids are held in the intermediate pressure zone for an average polymer solids residence time, and the polymer solids residence time is sufficient to separate substantially all unentrained diluent from the polymer solids.

16. A process according to claim 11 wherein the step for controlling the rate of the withdrawing the polymer solids from the intermediate pressure zone comprises:

establishing a first signal representative of the actual level of the polymer solids in the intermediate pressure zone;

establishing a second signal representative of a desired level of the polymer solids in the intermediate pressure zone;

comparing the first signal and the second signal and establishing a third signal responsive to the difference between the first signal and the second signal; and

manipulating the solids outlet control valve in response to the third signal.

17. A process for slurry polymerization of olefins and for separating polymer solids from diluent, the process comprising:

polymerizing in a reaction zone at least one olefin monomer in a liquid diluent to produce a fluid slurry comprising the liquid diluent and polymer solids;

withdrawing a portion of the slurry from the reaction zone;

introducing the withdrawn portion of the fluid slurry to an intermediate pressure zone in which a majority of the diluent is separated from the polymer solids, wherein the intermediate pressure zone is at a pressure in the range of 100-1500 psia;

holding the polymer solids in the intermediate pressure zone for a polymer solids residence time sufficient to remove substantially all the unentrained diluent; and

withdrawing the polymer solids from the intermediate pressure zone; and

transferring the polymer solids to a purge zone to remove substantially all the entrained diluent.

18. A process according to claim 17 wherein the polymer solids residence time is from about 10 seconds to about 30 minutes.

19. A process according to claim 17 wherein the polymer solids residence time is from about 30 to about 120 minutes.

20. A process according to claim 17 wherein a desired level of polymer solids are maintained in the intermediate pressure zone, and the polymer solids are withdrawn from the intermediate pressure zone by uniform flow.

21. A process according to claim 17, further comprising controlling the rate of the withdrawal the polymer solids from the intermediate pressure zone by manipulating a solids outlet control valve.

22. An apparatus for separating diluent from polymer solids, the apparatus comprising:

(a) an intermediate pressure chamber adapted for the separation of diluent vapor from polymer solids, the chamber having an inlet for receiving a fluid slurry comprising diluent and polymer solids from a slurry reactor, a solids outlet for discharging polymer solids, and a gas outlet for discharging vaporized diluent;

(b) a level sensor in contact with the intermediate pressure chamber for sensing the level of polymer solids in the intermediate pressure chamber;

(c) an outlet valve fluidly connected to the solids outlet of the intermediate pressure chamber, wherein the outlet valve is manipulated in response to the sensed level;

(d) a condenser fluidly connected to the gas outlet for receiving and condensing without compression the vaporized diluent; and a purge column fluidly connected to the outlet valve, the purge column receiving the polymer solids from the intermediate pressure chamber.

23. The separating apparatus of claim 22, further comprising:

a fluff chamber downstream of and fluidly connected to the outlet valve;

a fluff chamber valve in fluid connection with the bottom of the fluff chamber;

a purge column in fluid connection with the fluff chamber valve; and

means for operating the outlet valve and the fluff chamber valve so that the valves are not open at the same time.

24. The separating apparatus of claim 23 wherein the fluff chamber houses a rotating device for avoiding polymer build-up and clogging.

25. The separating apparatus of claim 23 wherein the fluff chamber has an angled bottom and a surface finish that facilities plug flow of the polymer solids.

26. The separating apparatus of claim 23 further comprising a flashline disposed between and fluidly connecting the intermediate pressure chamber and the slurry reactor; and a flashline heater in heat exchange relation with at least a majority of the length of the flashline.

27. The separating apparatus of claim 22, further comprising a first transporter tank downstream of and fluidly connected to the outlet valve.

28. The separating apparatus of claim 27 wherein the first transporter tank is upstream of an fluidly connected to a purge column.

29. The separating apparatus of claim 27, further comprising:

a second transporter tank downstream of and fluidly connected to the outlet valve; and

a transporter tank controller operatively connected to the first and second transporter tanks, the controller being adapted to alternate the flow of polymer solids between the first and second transporter tanks.

30. The separating apparatus of claim 22 wherein the intermediate press chamber is also a transporter tank.

31. An apparatus for separating diluent from polymer solids, the apparatus comprising:

(a) an intermediate pressure chamber in which diluent is separated from polymer solids;

(b) a fluid passage connected at one end to a bottom portion of the intermediate pressure chamber;

(c) a purge column connected at an opposite end of the fluid passage;

(d) a condenser fluidly connected to the flash gas outlet for receiving and condensing without compression the vaporized diluent; and

(e) a recycle line for transferring the condensed diluent to the slurry reactor; wherein the separating apparatus does not comprise a low pressure flash chamber.

32. The separating apparatus of claim 31, further comprising:

an outlet valve disposed along the fluid passage;

a fluff chamber downstream of and fluidly connected to the outlet valve;

a fluff chamber valve disposed along the fluid passage and in fluid connection with the bottom of the fluff chamber; and

means for operating the outlet valve and the fluff chamber valve so that the valves are not open at the same time.

33. The separating apparatus of claim 32 wherein the fluff chamber houses a rotating device for avoiding polymer build-up and clogging.

34. The separating apparatus of claim 31 wherein the fluff chamber has an angled bottom and a surface finish that facilities plug flow of the polymer solids.

35. The separating apparatus of claim 31 further comprising a flashline fluidly connected with and upstream of the intermediate pressure chamber; and a flashline heater in heat exchange relation with at least a majority of the length of the flashline.

36. The separating apparatus of claim 31 further comprising a timer connected to the outlet valve, wherein the timer determines the opening and closing of the outlet valve.

37. The separating apparatus of claim 31, further comprising a first transporter tank downstream of and fluidly connected to the outlet valve.

38. The separating apparatus of claim 37 wherein the first transporter tank is upstream of an fluidly connected to a purge column.

39. The separating apparatus of claim 37, further comprising:

a second transporter tank downstream of and fluidly connected to the outlet valve; and

a transporter tank controller operatively connected to the first and second transporter tanks, the controller being adapted to alternate the flow of polymer solids between the first and second transporter tanks.

40. The separating apparatus of claim 31 wherein the intermediate press chamber is also a transporter tank.